



## Rapid Empirical Innovation (REI) Lowering the Cost of Discovery

The Rapid Empirical Innovation (REI) process, as developed and demonstrated by M Ship Co., literally takes testing “out of the box” of traditional tow tanks to quickly and accurately evaluate potentially valuable design concepts that otherwise would lie dormant and unexplored. The REI process is a means for developing and refining innovative marine concepts in time- and cost-effective manners.

Hull models are accurately fabricated using N/C-milled rapid prototyping techniques and evaluated on a self-powered, open-water tow testing platform that provides real-time force, trim, and acceleration measurements along with realistic flow visualization.



*M Ship's Proprietary REI Hull Testing Program*

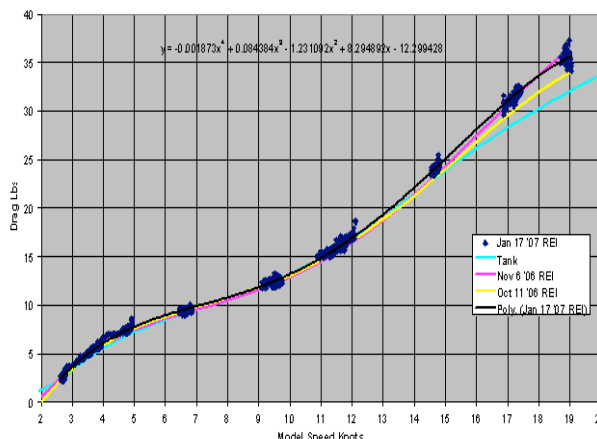
The REI methodologies and test apparatus has undergone five years of detailed development and refinement. Test data correlation to towing-tank model scale data is generally good, with only marginally higher levels of experimental uncertainty. Comparison of REI flow visualization data to full scale performance characteristics is excellent. REI's accelerated learning curve, potential for broad evaluated design space, and significant cost savings easily outweigh any quantified risks.

Currently, M Ship's REI apparatus can evaluate individual models in calm water environments. However, with new operational emphasis on vessel high speed ride quality (especially relative to impact shock loads and accelerations experienced by passengers and crew), we readily envision a next-generation extension of the REI program. REI-Version 2 will encompass an improved self-propelled test platform bridging the technology and features commonly associated with traditional towing tank testing.

The apparatus will offer tandem testing of two models simultaneously, with one model serving as an all-important established reference. Test data for all other hull form variants is easily anchored to this benchmark. The platform will be fully rough-water capable. High-frequency 6-DOF accelerometers will be outfitted to each model yielding comprehensive motion and acceleration comparisons in identical as-tested wave conditions.

M Ship is soliciting strategic partnerships and technology funding earmarked to develop and implement a fully-functional REI-Version 2 test platform that will be well-suited to advanced hullform design and analysis.

- Proven Qualification -- Extensive REI testing was conducted on a 1:6 scale hybrid planing-hull that was identical to a sister model tested at the towing tank facility of Stevens Institute / Davidson Labs. A direct overlay of these data sets (resistance curves, running trim angle curves) shows excellent correlation. Further, several repeat REI test sessions were conducted months apart, with excellent data correlation and repeatability.



*Successful REI Qualification*

- Broad Design Space, Rapid Results -- M Ship has evaluated several systematic series of hull forms with its REI test program. The full turn-around time from conceptual hullform design to in-hand, as-tested performance data is rapid – as fast as four weeks.
- Affordable – The REI program offers a 50% to 80% cost savings (model construction and testing) when compared to the experimental programs of conventional towing tanks.
- A Winning Approach -- M Ship's REI test program offers an accurate, rapid, and cost-effective approach to investigation of improved hull form designs, with achieved and proven results. Our proposed “Version 2” expands this vision with tandem testing and rough water capability.